



# UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE  
United States Patent and Trademark Office  
Address: COMMISSIONER FOR PATENTS  
P.O. Box 1450  
Alexandria, Virginia 22313-1450  
[www.uspto.gov](http://www.uspto.gov)

| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|-----------------|-------------|----------------------|---------------------|------------------|
| 10/050,322      | 01/15/2002  | Ming Huan Tsai       | 67,200-613          | 3498             |

7590 04/13/2005

TUNG & ASSOCIATES  
838 W. Long Lake Road, Suite 120  
Bloomfield Hills, MI 48302

EXAMINER

BARRECA, NICOLE M

ART UNIT PAPER NUMBER

1756

DATE MAILED: 04/13/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

## Office Action Summary

Application No.

10/050,322

Applicant(s)

TSAI ET AL.

Examiner

Nicole M. Barreca

Art Unit

1756

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 17 February 2005.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1,3,5,7,11-13,23-26 and 30-38 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1,3,5,7,11-13,23-26 and 30-38 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- ☒ Notice of References Cited (PTO-892)
- ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date \_\_\_\_\_.
- ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date \_\_\_\_\_.
- ☐ Notice of Informal Patent Application (PTO-152)
- ☐ Other: \_\_\_\_\_.

### **DETAILED ACTION**

1. Claims 1, 3, 5, 7, 11-13, 23-26, 30-38 are pending in this application.

#### ***Claim Objections***

2. Claims 11 and 25-26, 30 and 31 are objected to because of the following informalities:

Claim 11 recites "the semiconductor feature". However since claim 1 does not recite a forming a semiconductor feature, it appears that this was intended to be "the opening". See claim 1, line 17-18.

Claim 25, line 6 recites "to from a first resist layer". It appears "from" was intended to be "form". Appropriate correction is required.

#### ***Claim Rejections - 35 USC § 112***

3. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

4. Claim 12 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 12 recites that the step of removing follows the step of dry developing but is prior to the step of plasma etching. This limitation is unclear since claim 1 as amended limited the "ashing process to remove overlying resist layers" (the only removal step in this claim) to occur after the plasma etching.

***Response to Amendment***

5. The 35 USC 102 and 103 rejections of the claims using the Ohuchi reference have been withdrawn in response to the applicant's amendments to the claims requiring the ashing step to follow the plasma etching step.

***Claim Rejections - 35 USC § 103***

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

7. Claims 1, 3, 5, 7, 11-13, 23-26, 30-38 are rejected under 35 U.S.C. 103(a) as being obvious over Tsai (US 6,787,455) in view of Douglas (US 5,545,290).

The applied reference has a common inventor with the instant application. Based upon the earlier effective U.S. filing date of the reference, it constitutes prior art only under 35 U.S.C. 102(e). This rejection under 35 U.S.C. 103(a) might be overcome by: (1) a showing under 37 CFR 1.132 that any invention disclosed but not claimed in the reference was derived from the inventor of this application and is thus not an invention "by another"; (2) a showing of a date of invention for the claimed subject matter of the application which corresponds to subject matter disclosed but not claimed in the reference, prior to the effective U.S. filing date of the reference under 37 CFR 1.131; or (3) an oath or declaration under 37 CFR 1.130 stating that the application and reference are currently owned by the same party and that the inventor named in the application is the prior inventor under 35 U.S.C. 104, together with a terminal disclaimer

in accordance with 37 CFR 1.321(c). This rejection might also be overcome by showing that the reference is disqualified under 35 U.S.C. 103(c) as prior art in a rejection under 35 U.S.C. 103(a). See MPEP § 706.02(l)(1) and § 706.02(l)(2).

Etching stop layer 16 and ILD layer 18 are formed substrate 12. A first photoresist layer of a non-silicon containing organic material is formed to a thickness of about 1000-5000 Angstroms. The first resist layer need not be photoactive or can be an I-line photoresist, acrylic polymer or polyvinyl alcohol polymer. A second photoresist layer 22 is formed to a thickness less than the first layer, such as with a thickness of about 500-3000 Angstroms. The second photoresist layer is a silicon containing organic including silicon monomers or may be a non-silicon containing photoresist which is subjected to a silylation process (col.4, 8-67). Photoresist layers 20 and 22 are exposed to light at 157 nm or 193 nm and photoresist layer 22 is conventionally (wet) developed. A dry development process is performed in a dual RF power source plasma to form an opening 26, forming an etching mask for a via opening in photoresist layer 20. The dry development chemistry includes carbon monoxide, oxygen and argon. Following dry development of photoresist layer 20 to form an etching mask, photoresist layer 22 may be removed using a first in-situ oxygen-containing ashing process (col.5, 1-62). Following via hole RIE etching (of inter-layer dielectric 18) the photoresist layer 20 is removed according to a second in-situ ashing process using an oxygen-containing plasma. The plasma in the first and second ashing steps may additionally contain nitrogen or fluorine to help in cleaning of the reactor chamber. Following the second ashing, another RIE etching process is performed to etch the etch stop layer, followed

by an in-situ plasma cleaning process. The in-situ cleaning process includes conditions such as those used for the ashing steps including a nitrogen or fluorine containing plasma (col.6, 14-47). See also Figures 1A-1F. Tsai performs the first etching process (dry development) of the first resist layer using carbon monoxide with the oxygen and argon gases and does not disclose using nitrogen with the oxygen and argon. Douglas teaches an etching method using photoresist where carbon monoxide or nitrogen is added as a passivant gas to the etchant. These passivant gases include pi bonding and/or paired electrons not involved in bonding, which creates weak adductive bonds to the sides of the opening being etched and increases the etch profile control. See the abstract. It would have been obvious to one of ordinary skill in the art to use nitrogen, instead of carbon monoxide, for the first plasma etching process in the method of Tsai because Douglas teaches that both carbon monoxide and nitrogen are passivant gases which include pi bonding and/or paired electrons not involved in bonding and that adding either to an etchant for photoresist will create weak adductive bonds to the sides of the opening being etched, and therefore will increase the etch profile control.

#### ***Response to Arguments***

8. Applicant's arguments with respect to the claims have been considered but are moot in view of the new ground(s) of rejection.

#### ***Conclusion***

9. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP

§ 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

10. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Nicole M. Barreca whose telephone number is 571-272-1379. The examiner can normally be reached on Monday-Thursday (9AM-7PM).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mark Huff can be reached on 571-272-1385. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Art Unit: 1756

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Nicole M Barreca  
Examiner  
Art Unit 1756

4/7/05

A handwritten signature in black ink, appearing to read "Nicole Barreca", written in a cursive style.